IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.: 10/730,430 Examiner: Lucy M. Thomas

Filing Date: December 8, 2003 Group Art Unit: 2836

Inventor: David G. Fullington Confirmation No.: 2325

Title: *Apparatus and Method For Disabling the Operation of High Powered Device*

Attorney Docket No. 1506.003

APPELLANTS' REVISED APPEAL BRIEF

Mail Stop – Appeal Brief - Patent
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

On or about January 17, 2008, Appellant appealed from the Final Rejection of claims 1, 3-4, 6-8, 10-15, and 24. On December 8, 2008, a Notification of Noncompliant Appeal Brief was issued noting that the citation to 37 CFR §1.192 below should be 37 CFR §41.37 and requesting that the withdrawn claims 5, 16 and 17 should be canceled.

The above noted citation error has now been corrected below, however, the Applicant believes that the request to cancel withdrawn claims is premature pending a determination of whether a generic claim is allowable. The Applicant refers to page 2 of the restriction requirement of November 18, 2005, 37 CFR §1.141(a) with respect to the rule concerning generic claims and 37 CFR §41.37(c)(1)(iii) indicating that claims properly may be marked in the Appeal Brief as "withdrawn".

The following Amended Appellant's Appeal Brief pursuant to 37 CFR § 41.37, is submitted in triplicate to replace the Appellant's Appeal Brief. Please charge any additional fees to Deposit Account No. 50-1170 (three additional copies of page 1 are attached).

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REAL PARTY IN INTEREST

The real party in interest of the above-identified application is Rockwell Automation, Inc., a Delaware Corporation, located and doing business at 1201 South Second Street, Milwaukee, Wisconsin.

RELATED APPEALS AND INTERFERENCES

None.

STATUS OF CLAIMS

The Examiner has rejected claims 1, 3, 7, 8, 11, 15, and 24 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,573,681 to Schwesig (the Schwesig patent) in view of U.S. Patent No. 5,904,666 to DeDecker (the DeDecker patent). In addition, the Examiner has rejected claims 4, 6, and 13-14 under 35 U.S.C. § 103(a) as being unpatentable over the Schwesig patent in view of the DeDecker patent and in further view of U.S. Patent No. 5,806,440 to Rowlette (the Rowlette patent).

All of the claims have been finally rejected, and the rejection of claims 1, 3-4, 6-8, 10-15, and 24 is appealed herein. The claims, as they presently stand, are found in the Claims Appendix to this Appellant's Appeal Brief.

STATUS OF AMENDMENTS

A Response After Final Office Action was filed by Applicant on November 15, 2007 in response to an Office Action dated September 25, 2007. On December 6, 2007, the Examiner issued an Advisory Action confirming the final rejection of claims 1, 3, 7, 8, 11, 15, and 24. No claim amendments are now pending.

SUMMARY OF CLAIMED SUBJECT MATTER

The present invention relates to an electronic motor drive circuit used for controlling high-powered electronic motors. *Specification paragraph [0001]*. These motors can be hazardous to those coming into contact with the motors, or the equipment associated with the motors, if the motors are not properly disable during that contact. *Specification paragraph [0003]*. Current standards for safely disabling motors require special contactors (electromechanical switches) called "safety relays" to disconnect the motors from their source of power. These contactors not only disconnect the motor from power but also provide safety features including fault contacts detecting contact "weld" and providing a high assurance that disconnection process has been successfully completed. The level of safety provided by safety relays has been quantified and the subject of multiple safety standards. *Specification paragraphs [0004]-[0005]*.

A safety relay large enough to interrupt the load of a high-powered motor is expensive and bulky. *Specification paragraph [0006]*. For this reason, the possibility of disabling the transistors in the motor drive directly has been considered. *Specification paragraph [0007]*. This method is not as reliable as that of using the safety relay on the output of the drive circuit because of the potential failure of the complex circuits normally used to activate and deactivate the transistors.

The present invention eliminates the need for a high-powered safety relay by disabling the input currents to the transistors within the motor drive circuit, an operation that requires the control of much smaller currents than disabling the output currents from the transistors. *Specification paragraph [0009]-[0010]*. The reliability of this disabling process is ensured by using a smaller safety relay to perform the disabling. This safety relay may communicate with

the necessary control points for the transistors of the drive circuit through a port on the motor drive, making the use of a safety relay practical and compatible with drive circuits that are also used for non-safety applications. *Specification paragraph [0024].* A safety relay is a type of relay that provides, among other features, fault contacts positively indicating whether contacts have become welded together. *Specification, paragraph [0025].*

The above description gives an overall summary of the preferred embodiment of the invention. The following summarizes the claims 1, 6, 7, 8, and 24 at issue. The remaining claims are considered to stand or fall with one of the below summarized claims.

Claim 1 is an independent apparatus claim that recites a drive circuit (10) for delivering high power to an AC motor (20). The drive circuit has a high power circuit (30) including a set of semiconductor switching devices (41) capable of being coupled to the motor and delivering the high level power thereto. A logic circuit (40) generates signals to control the semiconductor switching devices. A low power circuit (100) transmits the signal from the logic circuit to the high power circuit only when the low power circuit is receiving electrical power. *Specification, paragraph [0020].* A safety relay having a contact connected to a power terminal of the low power circuit controls the application of power to the low power circuit. *Specification paragraph [0024].* The safety relay is electrically isolated from the logic circuit. *Specification, Fig 1 showing actuation coil 114 electrically unconnected to the microprocessor 80 and other circuitry of the low-voltage section.*

Claim 6 is an apparatus claim dependent on claim 4 wherein the safety relay includes a coil (114), a normally-open contact (116), and a normally-closed contact (118) and wherein the contacts are physically coupled so that only one of the contacts can be closed at any given time,

and wherein the safety relay disables the low power circuit when power is provided to the coil. *Specification, paragraph [0025], Fig. 1.*

Claim 7 is an apparatus claim dependent on claim 1 wherein the safety relay is coupled to an override port (106) of the low power circuit, and wherein the safety relay disables the low power circuit by providing a first signal to the override port of the low power circuit. *Specification, paragraph [0026], Fig. 1.*

Claim 8 is an apparatus claim dependent on claim 7 wherein the safety relay includes a hardware switch (116) that is capable of being switched to apply a signal to the override port (106) of the low power circuit. *Specification, paragraph [0026], Fig. 1.*

Claim 24 is an independent apparatus claim that recites a motor drive circuit (10) for delivering high-level power to an AC motor (20). The drive circuit has a high power circuit (30) including a set of semiconductor switching devices (41) capable of being coupled to the load and delivering the high level power thereto. A logic circuit (40) generates signals to control the semiconductor switching devices and a low power circuit (100) transmits the signals from the logic circuit to the high power circuit only when the low power circuit is receiving electrical power. A set of ports (120, 122) exposed by the drive allow connection of a safety relay electrically independent of the logic circuit to the drive to control the application of power to the low power circuit. *Specification, paragraph [0024], Fig. 1.*

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The issues presented for review are as follows:

Whether claims 1, 3, 7, 8, 11, 15, and 24 are patentable under 35 U.S.C. § 103(a) over U.S. Patent No. 6,573,681 to Schwesig (the Schwesig patent) in view of U.S. Patent No. 5,904,666 to DeDecker (the DeDecker patent). Whether claims 4, 6, and 13-14 are patentable

under 35 U.S.C. § 103(a) over the Schwesig patent in view of the DeDecker patent and in further view of U.S. Patent No. 5806440 to Rowlette (the Rowlette patent).

For the purposes of this appeal, claims 1, 3, 4, 11-15 stand or fall together, independent from the other claims appealed herein; claims 8 and 10 stand or fall together, independent from the other claims appealed herein; and claims 6, 7, and 24 stand or fall independently of each other and the other claims appealed herein.

ARGUMENT

I. Background

The primary reference of Schwesig shows an alternative to the present invention in which a motor drive is disabled by disabling its power transistors using switches controlled by the same microprocessors that operate the motor drive. Both microprocessors must fail before the motor may be accidentally started. This provides some degree of safety beyond providing a command to the motor drive to stop. A stop command alone would not meet safety standards because of the risk of drive malfunction allowing the motor to remain on.

While the Schwesig reference addresses the same problems as the present invention, it adopts a completely different approach to this problem, relying on the increased complexity of dual microprocessors rather than on the decreased complexity of a safety relay that may plug into a port on the motor drive. The Schwesig approach has a significant shortcoming in that the motor might accidentally start if there is a systematic error reproduced in both microprocessors or their software. Systematic errors in identical microprocessors and programs are not unlikely and if such errors prevent the microprocessor in Schwesig from disabling the power transistors, human operators may be placed at risk. In contrast, the present invention preserves the proven reliability and simplicity of the safety relay and, by incorporating it into the internal signal path of the motor drive through a set of ports, significantly reduces the cost of this well characterized safety approach.

II. Rejection of Claim 1

The Examiner's rejection of claim 1 as being obvious over Schwesig in view of DeDecker contains the following errors:

A.· Claim 1 requires "a safety relay".

In the rejection of claim 1 on paragraph 1 of page 2 of the Office Action, the Examiner states: " Schwesig discloses... a safety relay S1, S2 to control the application of power to the low powered circuit." S1, S2 of Schwesig are designated as "electrical or mechanical switches". Inferentially, a mechanical switch in this context would be a relay, but even so, there is no indication that these relays are safety relays. "Safety relay" is a term of art which refers to a particular type of relay having features making it suitable for safety circuitry meeting international standards and including particularly a "fault" contact that detects contact welds. This type of relay is also termed a "force guided contacts relay" referring to the fact that if one contact is immobilized, none of the others will move. A person of ordinary skill in the art would understand this term, recognize this distinction (which is also described in the specification), and know that Schwesig neither teaches nor intends the use of a safety relay in this circuit.

Further, a person of ordinary skill in the art would understand that a safety relay could not be practically operated by a microprocessor control signal as disclosed in Schwesig and would serve no purpose in guarding against microprocessor failure if driven by the microprocessor as shown in Schwesig.

Accordingly, the Examiner has failed to find a critical element of claim 1 in the Schwesig. Nor has the Examiner provided a factual foundation for the assertion that a person of ordinary skill in the art at the time of the invention would be led to modify the Schwesig reference to produce the present invention.

DeDecker does not remedy the deficiency of Schwesig, describing neither a safety relay nor a motor controller of the type described in the present invention. DeDecker discloses a wearable medical device where a pump motor is shut off by an unspecified device during a software failure by a watchdog timer. The present invention does not shut off the motor in

response to software failure or according to a time delay but independently of time and of the software either working or failing. There is no suggestion in the art or elsewhere of how to combine the teachings of DeDecker's medical blood pump and watchdog timer with a high-powered industrial motor drive.

B. Claim 1 requires that the "safety relay" be "electrically isolated" from the logic circuit.

Electrical isolation between the operation of the safety relay and the logic circuit is important to the present design so that an error in the logic circuit (e.g. a microprocessor crash) cannot override the safety relay. If these two systems are not isolated, the introduction of a safety relay would provide for no more safety than provided by the microprocessor alone.

In stark contrast to the present claims, the switches S1, S2 of Schwesig are electrically connected to and controlled by the logic circuit (microprocessors I1, I2) as can be seen in Fig. 1a. Such an electrical connection is the opposite of being electrically isolated as required by claim 1. As a practical matter, this electrical connection means that a failure of microprocessors I1, I2 can activate switches S1 and S2 starting the motor. Thus Schwesig teaches away from the present invention both in structure and function.

Again, DeDecker does not remedy the deficiency of Schwesig, describing neither a safety relay nor a motor controller of the type described in the present invention.

III. Rejection of Claim 6

The Examiner's rejection of claim 6 as being obvious over Schwesig in view of DeDecker and Rowlette contains the following error:

A. Claim 6 requires that the safety relay have normally open and normally closed contacts that are physically coupled so that only one can close at a given time and where the safety relay disables a low powered circuit when power is provided to the coil.

The Examiner suggests that force guided contacts per the present invention and this claim element are taught by Rowlette in the form of relays K1 and K2 which are shown only schematically in Rowlette. While it is clear that these relays have normally open and normally closed contacts, which during normal operation change state in tandem, there is no indication that the contacts are linked so that only one can close at a time, particularly in the case of, for example, a contact weld. See, for example, the specification of the present invention at paragraph [0005] describing this problem. When contacts are supported on flexible cantilevered members or bifurcated arms, a contact weld can occur and still permit simultaneous closure of both normally open and normally closed contacts. This problem led to the development of the safety relay. There is no reason to believe that Rowlette is describing safety relays in this air-conditioning control application.

Equally important, there is no indication in Rowlette that the relay in Rowlette is configured to disable a low power circuit associated with a risk to a human operator when power is provided to the coil as opposed to when power is not provided to the coil. The Rowlette reference has no relationship to the present invention's motivations or goals and represents little more than a naked example of a relay. Significantly, the Schwesig reference, which better represents the understanding of the prior art in this field, pointedly does not use a relay of this kind nor does it suggest this particular switching logic.

Thus, there is no support in the references, alone or in combination, for this limitation.

IV. Rejection of Claim 7

The Examiner's rejection of claim 7 as being obvious over Schwesig in view of DeDecker contains the following error:

A. Claim 7 requires that the safety relay is also coupled to an override port of the low power circuit.

The present invention, by allowing the safety relay to not only remove power from the low powered circuit but also control its enable input, provides two levels of safeguard. This is not taught by the references that have been cited.

The Examiner suggests that support for this claim limitation is found in diodes SV1_Diag and SV2_Diag in Schwesig. These diodes do not meet the claim limitation for the following two reasons:

(1) they do not go to an override port, they go to an input to the microprocessor to confirm operation of the switch SV. An input port doesn't override the microprocessor nor is it used for that purpose in Schwesig.

(2) they do not go to the low powered circuit. The microprocessors correspond generally with the "logic circuit" of the claims and the Examiner has expressly stated that the low powered circuit is block 'A' in the drawing " excluding I1 and I2" (where I1 and I2 are the microprocessors).

Thus, none of the references alone or in combination teach this claim limitation

V. Rejection of Claim 8

The Examiner's rejection of claim 8 as being obvious over Schwesig in view of DeDecker contains the following error:

A. Claims 8 requires that the safety relay include a "hardware switch" which is coupled to the "override port of the low powered circuit".

Whereas in claim 7 the Examiner identifies the diodes SV1_Diag and SV2_Diag as applying a signal to the override port, in this dependent claim the Examiner identifies instead the hardware switches S1 and S2 as applying the signal to the override port. The Examiner's arguments with respect to claim 8 thus contradict (and are mutually exclusive with) the Examiner's arguments with respect to claim 7. Because claim 8 includes both the limitations of claim 7 and claim 8, the Examiner has failed to make a prima fascia case of finding all of the elements of claim 8 in the prior art.

Regardless, the identified switches S1 and S2 of Schwesig still fail to meet the claim limitations because the switches S1 and S2 do not connect to an override port; they control power at the anodes of optoisolators. Even ignoring meaning of "override port" as provided by the present application, the Examiner has already relied upon the anodes of the optoisolators with respect to teaching controlling a power to the "low power circuit" in claim 1. Thus, this identification of the diode anodes in Schwesig improperly "double counts" a single element in Schwesig against two different elements in the claims in addition to the contradiction noted above.

VI. Claim 24

The Examiner's rejection of claim 24 as being obvious over Schwesig in view of DeDecker contains the following errors:

A. Claim 24 requires "a safety relay".

For the same reason as described above with respect to claim 1, the cited references fail to support the Examiner's burden in finding a safety relay used in this inventive combination in the prior art.

B. Claim 24 requires "a set of ports exposed by the drive" allowing connection of the safety relay that is neither taught nor suggested by the references.

It is apparent that electrical or mechanical switches S1, S2 of Schwesig are closely integrated with the microprocessors I1 and I2 of Schwesig and in fact driven directly by low-voltage microprocessor signals. A person of ordinary skill in the art would thus understand there is no purpose or benefit to be gained by providing ports exposing these low-voltage signals for an external device. This is consistent with the fact that Schwesig simply fails to teach any ports as claimed.

DeDecker does not remedy this deficiency. Nor has the Examiner provided any objective basis for modifying these references to produce the system of the present invention.

In the present invention, the ports not only allow for the integration of a relatively large electromechanical device into a sophisticated integrated circuit system, but preserve the highest degree of electrical and mechanical isolation between the safety relay and the microprocessor circuitry by placing the former outside the housing of the latter. The references wholly fail to teach this approach, this structure, or these benefits.

CONCLUSION

The combination of references relied upon does not fairly teach the limitations of claims 1, 3-4, 6-8, 10-15, and 24. Therefore, the Applicant requests that the Board overturn the Examiner's rejection of these claims and pass such claims to allowance.

Respectfully Submitted,

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CLAIMS APPENDIX

1. (Previously Presented) A drive circuit for delivering high-level power to an AC motor, the drive circuit comprising:

a high power circuit including a set of semiconductor switching devices capable of being coupled to the motor and delivering the high level power thereto;

a logic circuit generating signals to control the semiconductor switching devices;

a low power circuit to transmit the signal from the logic circuit to the high power circuit only when the low power circuit is receiving electrical power; and

a safety relay having a contact connected to a power terminal of the low power circuit to control the application of power to the low power circuit, wherein the safety relay is electrically isolated from the logic circuit.

2. (Cancelled)

3. (Previously Presented) The drive circuit of claim 1, wherein the safety relay is coupled to a power terminal of the low power circuit, and wherein the safety relay decouples the power terminal of the low power circuit from a power supply in order to disable the low power circuit.

4. (Previously Presented) The drive circuit of claim 1, wherein the safety relay is coupled to a pull-up resistor of the low power circuit, and wherein the safety relay disables the low power circuit by at least one of coupling the pull-up resistor to ground and decoupling the pull-up resistor from a power supply.

5. (Withdrawn) The drive circuit of claim 4, wherein the safety relay additionally is coupled to a power terminal of the low power circuit, and wherein the safety relay couples the power terminal of the low power circuit to ground in order to further disable the low power circuit.

6. (Previously Presented) The drive circuit of claim 4, wherein the safety relay includes a coil, a normally-open contact, and a normally-closed contact, wherein the contacts are physically coupled so that only one of the contacts can be closed at any given time, and wherein the safety relay disables the low power circuit when power is provided to the coil.

7. (Previously Presented) The drive circuit of claim 1, wherein the safety relay is coupled to an override port of the low power circuit, and wherein the safety relay disables the low power circuit by providing a first signal to the override port of the low power circuit.

8. (Previously Presented) The drive circuit of claim 7, wherein the safety relay includes a hardware switch that is capable of being switched between first and second states, and wherein, when the switch is switched in the first state, the safety relay provides the first signal to the override port of the low power circuit.

9. (Cancelled)

10. (Previously Presented) The drive circuit of claim 8, wherein the high power circuit includes at least one coil that outputs a signal indicative of a current delivered by the high power circuit to the motor, and wherein a determination is made regarding whether the signal indicative of the current is proper when the switch is switched in the first state.

11. (Previously Presented) The drive circuit of claim 1, wherein the low power circuit includes an inverter circuit, and a buffer circuit.

12. (Previously Presented) The drive circuit of claim 11 wherein, when the low power circuit is not disabled, the logic circuit outputs a plurality of preliminary signals to the inverter circuit, the inverter circuit converts the plurality of preliminary signals into a plurality of modified signals, and the buffer circuit provides at least one control signal in response to the plurality of modified signals, and each of the preliminary signals, the modified signals, and at least one control signal is a pulse width modulated (PWM) signal.

13. (Previously Presented) The drive circuit of claim 11, wherein the inverter circuit has open collector output terminals that are coupled to the buffer circuit, wherein the safety relay is coupled to a pull-up resistor that is coupled between the safety relay and both the open collector output terminals and a corresponding input terminal of the buffer circuit, and wherein the safety relay at least one of decouples the pull-up resistor from a power supply and couples the pull-up resistor to a ground in order to disable the low power circuit.

14. (Previously Presented) The drive circuit of claim 13, wherein the safety relay also is coupled to an additional pull-up resistor that is coupled to a third circuit portion that is coupled to an enable input of the buffer circuit, and wherein the safety relay at least one of decouples the additional pull-up resistor from the power supply and couples the additional pull-up resistor to the ground in order to further disable the low power circuit by disabling the buffer circuit.

15. (Previously Presented) The drive circuit of claim 1, wherein the high power circuit includes a plurality of high power transistor devices that are light-actuated and a plurality of photodiodes receive the at least one control signal from the lower power circuit, and wherein the high power transistor devices are electrically isolated from the photodiodes.

16. (Withdrawn) The drive circuit of claim 1, wherein the safety circuit is an isolation device that is capable of communicating a signal provided from an additional device to the low power circuit.

17. (Withdrawn) The drive circuit of claim 16, wherein the isolation device includes one of a DC-to-DC converter and an optical isolator.

18-23. (Cancelled)

24. (Previously Presented) A motor drive circuit for delivering high-level power to an AC motor, the drive circuit comprising:

a high power circuit including a set of semiconductor switching devices capable of being coupled to the load and delivering the high level power thereto;

a logic circuit generating signals to control the semiconductor switching devices;

a low power circuit to transmit the signal from the logic circuit to the high power circuit only when the low power circuit is receiving electrical power; and

a set of ports exposed by the drive allowing connection of a safety relay electrically independent of the logic circuit to the drive to control the application of power to the low power circuit.

25. (Canceled)

EVIDENCE APPENDIX

Applicant submits no evidence pursuant to 37 CFR § 1.130, 1.131 or 1.132 or any other evidence beyond the references cited in the present application.

RELATED PROCEEDINGS APPENDIX

No decision from a related proceeding has been rendered by a court or this Board.